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IX.

CONTRIBUTIONS FROM THE CHEMICAL LABORATORY OF
HARVARD COLLEGE.A NEW METHOD OF PREPARING BORNEOL FROM
CAMPHOR.

BY C. LORING JACKSON AND A. E. MENKE.

Presented June 13th, 1883.

THE natural borneol (Borneo camphor), obtained from the *Dryobalanops Camphora*, is brought from the East so rarely that specimens of it can be obtained in this country or in Europe only with the greatest difficulty; most chemists, who have studied this substance, have confined their attention therefore to the borneol obtained from ordinary camphor, which has been proved to be identical* with the natural product.

So far as we can find, there are but two methods of making borneol from camphor, — one by the action of potassic hydrate, which is due to Berthelot,† the other that of Baubigny,‡ consisting in treating camphor with sodium, and separating the sodium camphor from the sodium borneol by carbonic dioxide. Both leave much to be desired, since the product of the first is a mixture of camphor and borneol, which must be purified by treatment with stearic acid, and according to Kachler§ the yield is very small, while the second yields pure borneol, it is true, but theoretically only one half of the camphor can be converted into borneol, although an amount of sodium is required which corresponds to the whole weight of camphor used.

In the course of some experiments on camphor, which led to no result so far as their main object was concerned, it was necessary for

* Kachler. Wien Acad. Ber. (2 Abth.), 78, July.

† Ann. Chim. Phys., ser. 3, lvi. p. 78.

‡ Ibid., ser. 4, xix. p. 221.

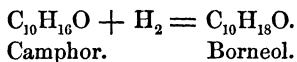
§ Ann. Chem. Pharm., clxiv. p. 75.

us to become acquainted with the reduction of camphor; but, to our great surprise, we were unable to find any description of experiments on this subject, unless the statement in Beilstein's *Handbuch der Organischen Chemie*, page 1763, that sodium amalgam does not act on camphor, comes under this head. We were compelled, therefore, to experiment ourselves, with the following result. 25 g. of camphor, melting at 175° , were dissolved in moist toluol, and sodium and water added at intervals, until a sample showed the melting-point of borneol, 197° – 198° ; the toluol was then driven off by heat, and a yellowish white mass obtained, with the smell at once like camphor and pepper, described as that of borneol. It was purified by sublimation, and analyzed with the following results:—

0.1642 g. of substance gave 0.4700 g. of carbonic dioxide, and
0.1772 g. of water.

	Calculated for $C_{10}H_{18}O$.	Found.
Carbon	77.93	78.07
Hydrogen	11.69	11.98

The substance is borneol, therefore, and the reduction of the camphor takes place, as was to be expected, according to the reaction.



The ease with which borneol was formed in this experiment led us to the following method for making borneol from camphor, which gives essentially the theoretical yield of nearly pure borneol with remarkably little trouble.

It consists in dissolving the camphor in about ten times its weight of common alcohol, and adding one third* more than the amount of sodium calculated from the reaction. The sodium is added in pieces of somewhat less than a gramme at a time, and in working with quantities not over ten grammes the action can be carried on in an open flask without cooling. As soon as all the sodium has disappeared, which takes less than three quarters of an hour with ten grammes of camphor, part of the alcohol is distilled off, and water added, which precipitates crude borneol. This is freed from sodic hydrate by washing with water; after which one crystallization from the smallest possible amount of hot alcohol is sufficient to raise its melting-point to 197° , that of borneol. In this way 10 g. of camphor yielded 9.5 g.

* Probably a smaller excess of sodium would be sufficient.

of the crude borneol, instead of 10.1 g., — that is, 94 per cent of the theory ; whereas, according to Baubigny's method, 4 g. of sodium, the amount which yielded 9.5 g. of borneol in our process, would have given only 6.6 g.

Our method, therefore, is superior to the other two in economy, as well as in the ease and speed with which it can be conducted.